H. E. COHEN.

ELECTRIC WATER HEATER AND STEAM GENERATOR.

APPLICATION FILED OCT. 12, 1920.

1,420,692.

Patented June 27, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

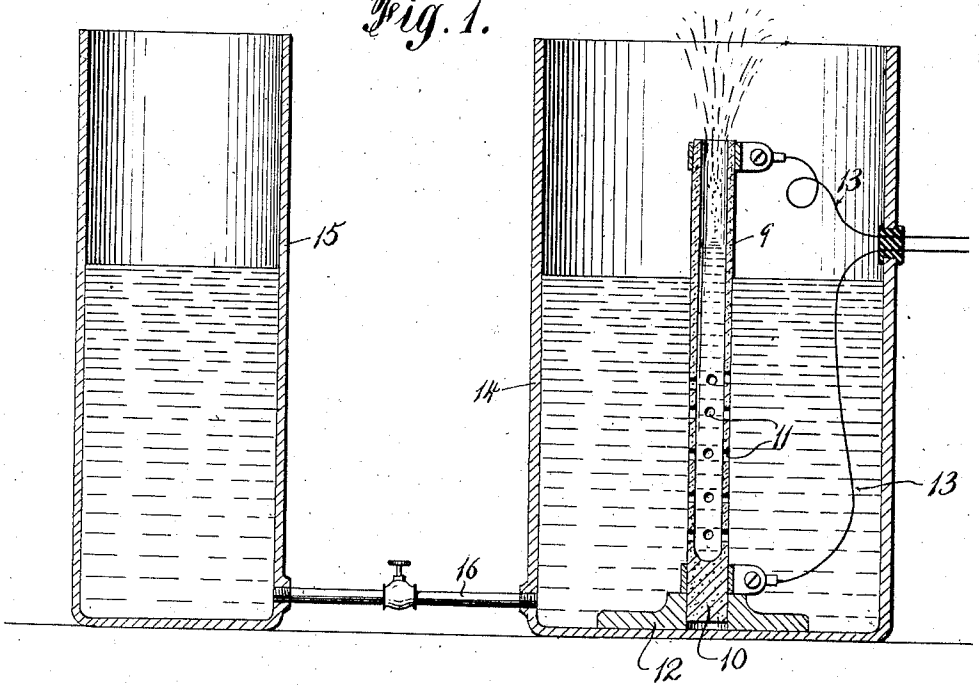
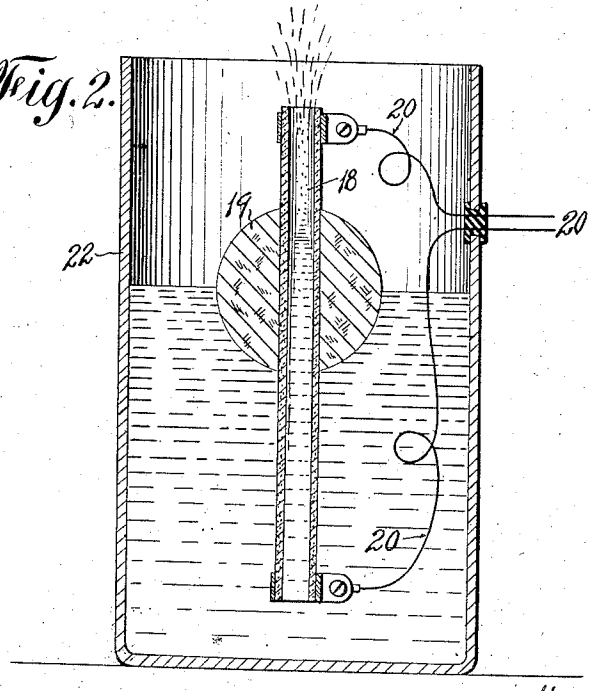


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

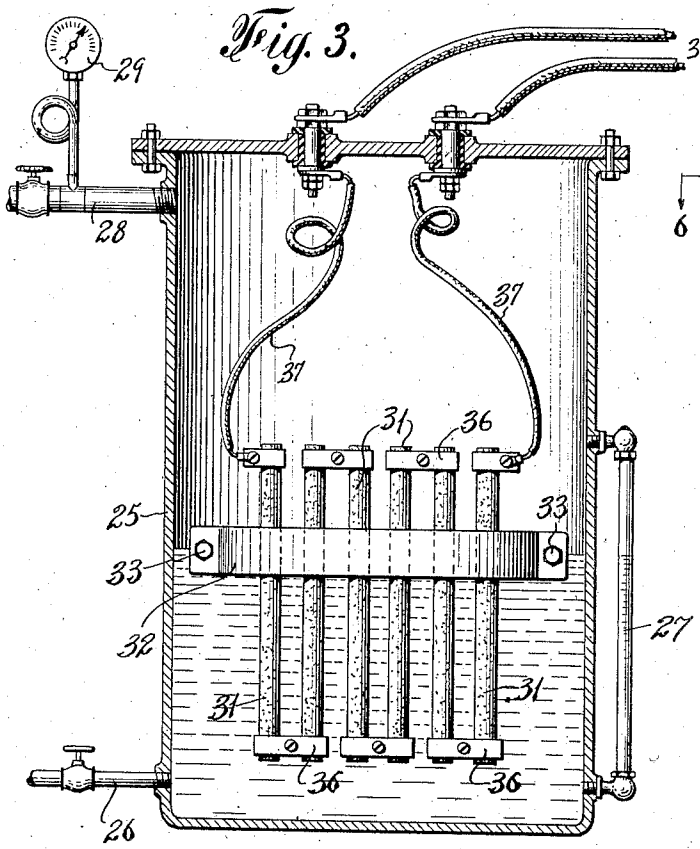


Fig. 5.

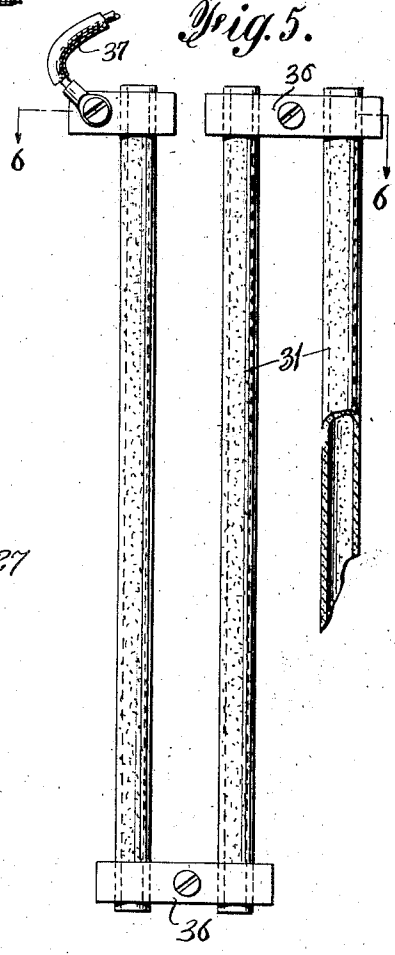


Fig. 4.

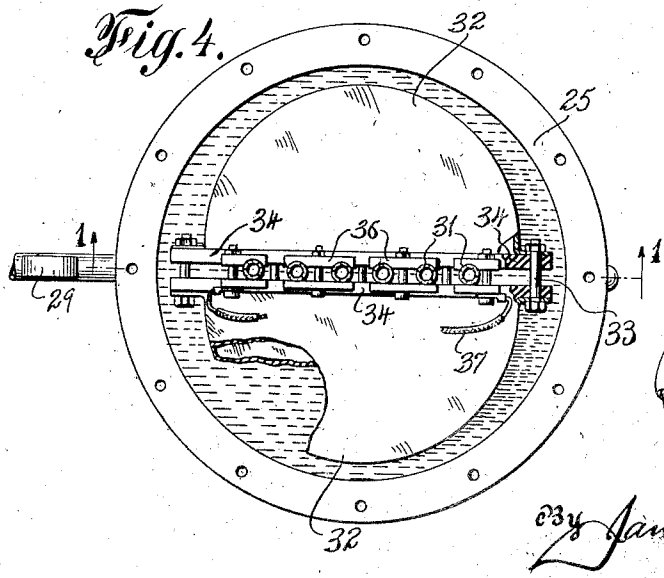
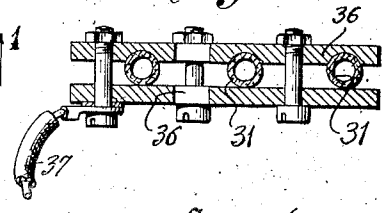


Fig. 6.



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UNITED STATES PATENT OFFICE.

HYMAN E. COHEN, OF BROOKLYN, NEW YORK.

ELECTRIC WATER HEATER AND STEAM GENERATOR.

1,420,692. Specification of Letters Patent. Patented June 27, 1922.

Application filed October 12, 1920. Serial No. 416,399.

To all whom it may concern:

Be it known that I, HYMAN E. COHEN, a citizen of the United States, residing at 1935 Bergen Street, in the borough of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Electric Water Heaters and Steam Generators, of which the following is a specification.

My invention relates to a method and means for generating steam and more particularly to an electrical steam generator and has special reference to the provision of a generator capable of producing high pressure steam for efficient commercial purposes with the use of electrical energy.

In certain types of machinery where steam is utilized for productive purposes, such as, for example, in garment pressing and laundering apparatus, it has been found desirable in many instances to replace the gas and gasolene heated boiler systems now used, with electrically heated equipment. A serious disadvantage, however, in the use of electrical energy for heating purposes generally lies in its high operating cost compared with the cost of gas or gasolene fuel. However, in the production of steam in the ordinary gas or gasolene heated boilers it is necessary to bring the entire mass of water in the boiler to the point of ebullition before steam is generated. This constitutes a large waste, especially where the amount of steam to be used is less than the steam capacity of the whole body of water and also in instances where the use of the steam is intermittent and not continuous, as in garment pressing machinery, for example, such boiler system requiring continuous application of heat to maintain the water at about the boiling point, if a reheating of the mass of water every time steam is desired is to be avoided, the latter alternative also involving considerable heat wastage. A steam generator, therefore, capable of turning a body of water into steam without the necessity of heating the entire body of water to the point of ebullition, the boiler being capable of intermittent use without concomitant heat wastage, is an obvious desideratum. One of the prime objects of my invention is the provision of such a generator in which electrical energy, otherwise inefficient for heating purposes, is used for the efficient production of commercial steam.

Moreover, in such machinery where steam is utilized for productive purposes, it is desirable to produce steam within a short period of time. In the gas or gasolene heated boilers considerable time is consumed before the mass of water in the boiler is brought to the point of ebullition and one has to expend considerable more time to generate steam of the desired pressure which in garment pressing machinery, for example, may be about sixty pounds. If only one or two garments are to be pressed, not only has energy been wasted in heating the whole body of water to the desired temperature, but time has been unduly consumed before the required steam and the required steam pressure is obtained. It has been found that with the steam generator contemplated by my invention steam production will begin almost instantly and the desired steam pressure obtained within a very short time.

It has also been found that for rapid generation of steam with a minimum of energy wastage, that electrical heating elements should be used which function to isolate or segregate a small volume of water and heat it by direct contact. By having the isolated water come in direct contact with the heating surfaces conducting the current, the water is immediately heated and steam is generated almost instantly upon closing the circuit including the heating element. The provision of such a system in which the walls of the current conducting element is in direct heating contact with the segregated water for the immediate and efficient conversion of the same into steam is another desideratum contemplated by my invention.

Experiments have further demonstrated that if a heating element having cylindrical current conducting walls, that is a tubular current conducting element be used, with the segregated water filling the core thereof, that a maximum concentration of heat is effected for the rapid conversion of the segregated water into steam. In such an element the core is instantaneously heated when the current is turned on, there being no surfaces in the core tending to cool the heated water and the generated steam, such water and steam coming only in contact with the heating or heated walls of the tube or the heat rays radiated therefrom. The provision of a system in which such heating tubes are used is another object of my invention.

In the use of such a tubular heating element, the element is immersed in water, a column of water filling the core thereof, the end of the element being exposed to the medium above the water level. The steam generated issues from the exposed end and fills the chamber above the water level, the steam thus collected being drawn off for further productive use. It has been found that with a tubular heating element of the kind here referred to different characteristics of steam may be obtained when the tube is moved longitudinally in the water, with different lengths of tube unimmersed. Thus, the longer the unimmersed portion the greater the superheating of the steam. It has been found that any desired characteristic of steam as respects its temperature may be obtained by arranging the heating elements a predetermined height above the water level and that such characteristics of the steam may be maintained constant by keeping constant the length of the unimmersed portion of the element, irrespective of the variation of the water level due to conversion of the water into steam and withdrawing of such steam from the generator.

For mass production of steam, to be used, for example, with high pressure systems, such as garment pressing apparatus, it is desirable to electrically connect a plurality of heating elements of the kind here referred to, each of the elements having an end exposed to the medium above the water level. My invention further contemplates the provision of such a system for mass production of steam.

The principal objects of my invention therefore involve, in addition to the provision of an electric steam generator which shall eliminate wastage of energy and unnecessary consumption of time before an operating stage is reached, the provision of a system in which steam may be economically produced in large quantities and at high pressure; the provision of a system in which the element segregating the water for steam conversion is an electrically conducting element; the provision of such a system in which the water and steam come only in contact with the surfaces of the direct heating element or the heat rays radiating therefrom; the provision of such a system in which the elements are adapted for producing superheated steam of any desired characteristic; the further provision of such a system in which the steam shall issue from the elements substantially normal to the water surface for the minimizing of condensation and the provision of a system of this kind in which the heating units are of the simplest nature and consequently inexpensive, in which breakages may be easily detected and tested and in which repair of parts will involve a negligible expense.

To the accomplishment of the foregoing and such other objects as may hereinafter appear, my invention consists in the elements and their relation one to the other, as hereinafter particularly described and sought to be defined in the claims, reference being had to the accompanying drawings which show preferred embodiments of my invention and in which:—

Figure 1 discloses a sectional view of a simple form of an electrical apparatus embodying the principles of my invention; and Figure 2 discloses a sectional view of a similar apparatus floated in water.

Figure 3 shows a sectional view of a steam boiler in which is installed the electrical apparatus for generating steam; and Figure 4 illustrates a plan view with the boiler cap removed to exhibit the interior of the boiler. Figure 5 illustrates a number of hollow electrical heating elements segregated from the apparatus; and Figure 6 is a sectional view taken on the line 6—6 of Figure 5.

Referring to Figure 1 of the drawings, I have shown my generator in simple form with the utilization of a single heating element. The heating element 9 for the efficient production of steam may comprise an electrically conducting tube which may be, for example, a carbon tube; the said tube being inserted in a body of water with the top end exposed to the medium above the water level. The said tube may be of dimensions substantially as shown in Figure 1; the tube being thus adapted to isolate or segregate a column of water of relatively small diameter when immersed in the body of water. The element 9 may be closed at an end 10 and may be provided with a plurality of orifices 11 in the side walls of the same, these orifices functioning as ports for the entering of water into a core of the said tubular element 9. The element 9 may be mounted on a flange 12, resting on the base of a receptacle 14, and to the ends of the tube 9 may be connected leads 13 forming part of an electric circuit.

The apparatus just described is installed in any suitable form of water receptacle or boiler 14, and an auxiliary water tank 15 is connected through a pipe 16, to the receptacle 14.

The water in the boiler 14 enters the generating tube 9 through the holes 11, and when the current is applied to the electric circuit 13, the hollow carbon tube 9 quickly attains a high temperature whereupon the water within the tube is rapidly generated into steam which issues from the top end thereof as shown in the drawing. The isolated or segregated water in the core of the tube comes only in contact with the direct heating surfaces of the said tube 9, the generated steam being highly heated by contact with the walls or surfaces of the

tube and the heat rays radiated therefrom. As shown in Figure 1 of the drawings, the steam issues from the tube in a direction normal to the water level in the receptacle, the steam collecting above the water level; this arrangement minimizing condensation of steam.

As the water within the tube is rapidly transformed into steam, the water outside thereof continuously flows into the tube to replenish the supply this resulting in a continuous jet or stream of steam discharged from the upper end of the tube 9.

For the purpose of producing superheated steam the top end of the heating element 9 may be extended above the water level, as shown in Figure 1, it having been found that the longer the extending end, the higher the temperature of the charge of steam issuing from the heating element. In order to produce steam of a desired characteristic, as, for example, steam of a given temperature, means is provided for supporting the heating element in the receptacle with the exposed end of the element kept constant in position with respect to the water level or with such end extending a predetermined and constant amount above the water level, irrespective of changes of the said water level during use. To this end I may provide the means shown in Figure 2 of the drawings, in which the tubular element 18, open both at the bottom and top ends thereof, is fixed to a float 19; leads 20 being connected preferably to the opposite ends of the tubular element 18, the said leads being included in an electrical circuit, the floated tubular element being immersed in a body of water in the receptacle or boiler tank 22, with an end of the tube 18 exposed to the medium above the water level and where superheated steam is desired, such end extending a predetermined amount above the water level.

When the current is applied to the circuit main 20, the steam generating tube 18 is quickly and highly heated which very rapidly transforms the water within the tube into steam which issues from the upper end thereof. As the water within the tube is generated into steam, a new supply continuously flows into the tube from the bottom thereof to form an uninterrupted operation of steam generation. As the water within the boiler 22 is transformed into steam and discharged therefrom, the generating apparatus follows the decrease in the level of the water so as to keep up a uniform generating action for the production of steam of uniform characteristics.

The electrical steam generator above described may be utilized in the production of an electric boiler for use in connection with garment presses, laundry machinery or other apparatus. As an example of a practical form of boiler, reference is made to the Figures 3 to 6 inclusive.

A boiler 25 is provided with the usual appliances for handling steam such as a water injection pipe 26, water gauge 27, steam outlet 28 and steam gauge 29.

An electrical steam generating element of the floating type is preferably used in this boiler. A plurality of tubular steam generating elements 31 are fixed to a float 32. The float is constructed according to any practical design, but in the drawings it is made in separable sections 32 with the tubes 31 anchored therebetween.

Bolts 33 hold the float sections together with the steam generating tubes anchored between insulating bars 34. The steam generating tubes are preferably alternately connected at the top and bottom with conductors 36 which join the several tubes in series. Each terminal of a circuit main 37 is joined to the tubes 31 so as to include them in series with the circuit main.

When an electric current flows through the circuit main 37 and traverses the series of hollow tubes 31, heat is generated in the tubes, and the water within the hollow tubes is very rapidly transformed into steam which issues from the tops of the tubes at a rapid rate and collects in the upper portion of the boiler. As the water in the tubes is transformed into steam the supply therein is continuously replenished by entering the bottom which sets up an unending discharge of steam from each and every tubular conductor 31 included in the series of heated tubes. The electrical steam generator remains at a constant depth in the water following the level thereof up and down during the period of operation.

Means is provided for withdrawing the collected steam from the receptacle or boiler 25 for further use, the said means comprising pipe section 28 connected for communication with the interior of boiler 25, the said pipe section being, in turn, connected at its other end (not shown) to the steam intake of the garment pressing machinery or other apparatus utilized therewith.

The operation of my apparatus will, in the main, be apparent from the above description thereof. With the heating elements immersed in the body of water in the boiler, the water will flow through the ports 11 of Figure 1 or through the bottom ends of the tubular elements shown in Figures 2 to 6 of the drawings and will seek its level in the core of the tubular heating elements, thus segregating or isolating a small column or columns of water for the heating thereof and the conversion of the same into steam. With the closing of the circuit to which these heating elements are connected the elements will be rapidly heated and the water in direct contact with the heating surfaces of the

current conducting elements will be instantaneously heated, resulting in the immediate conversion of the water into steam and the issuance thereof from the exposed or projecting ends of the said heating elements. The tubes are floated in the water in the boiler, the exposed portion of the said tubes or the extending portions thereof being kept constant in position with respect to the water level, this producing a constant and uniform characteristic of steam.

It will be thus apparent that I have provided a steam generating unit capable of rapid use for the production of steam utilized for further productive purposes, as in garment pressing machinery, for example, such a steam generating system or unit being highly efficient, especially when used for intermittent purposes, such a system eliminating the necessity of heating a body of water to the point of ebullition before steam production or generation is effected. It will be apparent also that the tubular conducting element with a hollow core provides a construction which will highly heat the air in the core during the initial stages of operation, causing rarification of the air and causing a quick upward suction of the column of water segregated in the tube, and in which the water will come only in contact with heated surfaces and moreover with directly heated surfaces for the generation of steam, which latter also passes only in contact with highly heated surfaces, such a system having been found capable of producing the steam of the necessary quantity and pressure.

While I have shown my device as applied to a steam boiler functioning for the generation of steam, I desire it to be understood that I do not intend to limit my invention to such use, my invention in its broader aspects including the use of my apparatus and the employment of the method for general purposes of vaporizing a liquid in situations where similar problems are involved.

While I have shown my device in the preferred form, it will be obvious that many changes and modifications may be made in the structure disclosed without departing from the spirit of the invention, defined in the following claims.

Having described my invention, its plan of construction and mode of operation, what I claim as new and desire to secure by Letters Patent is:

1. The method of generating steam which consists in providing an electrically conducting heating element, in immersing said element in a body of water with an end of said element exposed to the medium above the water level, said element adapted to isolate a portion of the water, the water coming in direct contact with the walls or surfaces of the electrically conducting heating element and in passing a current through the said element for the heating of the same substantially throughout its length, the parts being so arranged that the isolated water will be increasingly heated as it moves up in the element and issue as steam from the exposed end thereof.

2. The method of generating steam which consists in providing an electrically conducting heating element, in immersing said element in a body of water with a portion of said element extending a predetermined amount above the water level, said element adapted to isolate a portion of the water, the water coming in direct contact with the walls or surfaces of the electrically conducting heating element and in passing a current through the said element for the heating of the same substantially throughout its length, the parts being so arranged that the isolated water will be increasingly heated as it moves up in the element and issue as steam from the extended portion thereof.

3. The method of generating steam, which consists in providing an electrically conducting tube, in immersing said tube in a body of water with an end of said tube exposed to the medium above the water level; said tube adapted to isolate a portion of the water, and in passing current through the said tube for the heating of the same substantially throughout its length, the parts being so arranged that the isolated water will be increasingly heated as it moves up in the tube and issue as steam from the exposed end thereof.

4. The method of generating steam, which consists in providing an electrically conducting tube, in immersing said tube in a body of water with a portion of said tube extending a predetermined amount above the water level; said tube adapted to isolate a portion of the water and in passing current through the said tube for the heating of the same substantially throughout its length, the parts being so arranged that the isolated water will be increasingly heated as it moves up in the tube and issue as steam from the extending portion thereof.

5. The method of generating steam, which consists in providing a heating element including an electrical conductor, in immersing said element in a water tank with an end of said element exposed to the medium above the water level; said element adapted to isolate a portion of the water, in then passing current through the conductor for the heating of the same, the parts being so arranged that the isolated water will be increasingly heated as it moves up in the element and issue as steam from the exposed end thereof and in then drawing off the steam from the said tank for further use.

6. The method of generating steam, which consists in providing an electrically conducting tube, in immersing said tube in a water tank with a portion of said tube extending a predetermined amount above the water level; said tube adapted to isolate a portion of the water, in then passing current through the tube for the heating of the same, the parts being so arranged that the isolated water will be increasingly heated as it moves up in the tube and issue as steam from the extending portion thereof and in then drawing off the steam from the said tank for further use.

7. The method of producing steam, which consists in providing a heating element including an electrical conductor, in immersing the element in a body of water, an end of said element exposed to the medium above the water level, in maintaining during use the exposed portion substantially constant in position relative to the water level; the said element adapted to isolate a portion of the water, and in passing a current through the said conductor for the heating of the same substantially throughout its length, the parts being so arranged that the isolated water will be increasingly heated as it moves up in the element and issue as steam from the extending portion thereof.

8. The method of producing steam, which consists in providing an electrically conducting tube, in immersing the tube in a body of water, a portion of said tube extending a predetermined amount above the water level, in maintaining during use the extending portion substantially constant in length; the said tube adapted to isolate a portion of the water, and in passing a current through the said tube for the heating of the same substantially throughout its length, the parts being so arranged that the isolated water will be increasingly heated as it moves up in the tube and issue as steam from the extending portion thereof.

9. The method of producing steam, which consists in providing an electrically conducting heating element, in immersing the element in a tank of water, an end of said element exposed to the medium above the water level, in maintaining during use the extending portion substantially constant in length; the said element adapted to isolate a portion of the water, in passing a current through the said element for the heating of the same substantially throughout its length, the parts being so arranged that the isolated water will be increasingly heated as it moves up in the element and issue as steam from the extending portion thereof and in then drawing off the steam from the said tank for further use.

10. The method of producing steam, which consists in providing an electrically conducting heating element, in immersing the element in a body of water, a portion of said element extending a predetermined amount above the water level, in floating the said element in the water in order to maintain the extending portion of the element a constant amount above the water level; the said element being adapted to isolate a portion of the water and in passing a current through the said element for heating of the same; the parts being so arranged that the isolated water will be increasingly heated as it moves up in the element and issue as steam from the extending portion thereof.

11. The method of producing a high pressure steam, which consists in electrically connecting a plurality of electrical heating elements, in immersing said elements in a body of water with an end of each element exposed to the medium above the water level; said elements adapted to isolate portions of the body of water, and in then passing current through the elements for the heating of the same; the parts being so arranged that the isolated water will be increasingly heated as it moves up in the elements and issue as a mass of steam from the exposed ends thereof.

12. The method of producing a high pressure steam, which consists in electrically connecting a plurality of electrically conducting tubes, in immersing said tubes in a body of water with a portion of each tube extending a predetermined amount above the water level; said tubes adapted to isolate portions of the body of water, and in then passing current through the tubes for the heating of the same substantially throughout the lengths thereof; the parts being so arranged that the isolated water will be increasingly heated as it moves up in the tubes and issue as a mass of steam from the extending portions.

13. The method of producing a high pressure steam, which consists in arranging a plurality of electrically conducting heating elements in substantially close formation, in immersing said elements in a tank of water with an end of each element exposed to the medium above the water level; said elements adapted to isolate portions of the body of water, in then passing current through the elements for the heating of the same substantially throughout the lengths thereof; the parts being so arranged that the isolated water will be increasingly heated as it moves up in the elements and issue as a mass of steam from the extending portion thereof and in then drawing off the steam from the said tank for commercial use.

14. The method of generating steam, which consists in providing an electrical heating element having inlet and outlet ports, in immersing said element in a body of water with an end of said element exposed to the medium above the water level;

the said exposed end comprising the outlet port, and in then passing current through the element for the heating of the same substantially throughout its length; the said element adapted to isolate a portion of the water and the parts being so arranged that the isolated water will be increasingly heated as it moves up in the element and issue as steam from the outlet port, the steam issuing in a direction from the said port perpendicular to the water level.

15. The method of generating steam, which consists in providing a plurality of tubular elements, each of the elements being open at the top, in immersing said elements in a water tank with a portion of the elements exposed a predetermined amount above the water level, the elements adapted to isolate portions of the water and in then passing current through the elements for the heating of the same substantially throughout their length; the parts being so arranged that the isolated water will be increasingly heated as it moves up in the element and issue as steam from the extending portion thereof in a direction normal to the water level.

16. The method of generating steam, which consists in providing a plurality of hollow or tubular elements, each of the elements being open at the top, in immersing said elements in a water tank with a portion of the elements extending a predetermined amount above the water level. the elements adapted to isolate portions of the water, in then passing current through the elements for the heating of the same substantially throughout their length; the parts being so arranged that the isolated water will be increasingly heated as it moves up in the elements and issue as steam from the extending portion thereof in a direction normal to the water level and in then drawing off the steam as it issues from the elements.

17. An apparatus for generating steam comprising a receptacle or tank for holding a body of water, an electrically conducting heating element in said tank, an end of said element being exposed to the medium above the level of water in the receptacle; the said element being constructed and adapted for segregating a portion of the body of water, the water coming in direct contact with said element and means for passing current through said heating element, whereby the segregated water will be increasingly heated as it rises through the element and issue as steam from the exposed end of the same.

18. An apparatus for generating steam comprising a receptacle or tank for holding a body of water, an electrically conducting tube in said tank, an end of said tube being exposed to the medium above the level of water in the receptacle; the said tube being adapted for segregating a portion of the body of water, and means for passing current through said heating element, whereby the segregated water will be increasingly heated as it rises through the tube and issue as steam from the exposed end of the same.

19. An apparatus for generating steam comprising a receptacle or tank for holding a body of water, a heating element including an electrical conductor in said tank, an end of said element being exposed to the medium above the level of water in the receptacle; the said element being adapted to isolate a portion of the water, means for passing current through the said element for heating the same, whereby the isolated water will be increasingly heated as it rises through the element and issue as steam from the exposed end of the same and means connected to the said receptacle for conducting the generated steam to other apparatus for further use.

20. An apparatus for generating steam comprising a receptacle or tank for holding a body of water, an electrically conducting tube including an electrical conductor in said tank, an end of said tube being exposed to the medium above the level of water in the receptacle: the said tube being adapted to isolate a portion of the water, means for passing current through the said tube for heating the same, whereby the isolated water will be increasingly heated as it rises through the tube and issue as steam from the exposed end of the same and means connected to the said receptacle for conducting the generated steam to other apparatus for further use.

21. An apparatus for generating steam comprising a receptacle or tank for holding a body of water, a heating element including an electrical conductor in said tank, an end of said element being exposed to the medium above the level of water in the receptacle; the said element being adapted to isolate a portion of the water, means for maintaining during use the exposed portion of the element substantially constant in position relative to the water level and means for passing current through the said element for heating the same, whereby the isolated water will be increasingly heated as it rises through the element and issue as steam from the exposed end of the same.

22. An apparatus for generating steam comprising a receptacle or tank for holding a body of water, an electrically conducting heating element in said tank, an end of said element being exposed to the medium above the level of water in the receptacle; the said element being constructed and adapted for segregating a portion of the body of water, the water coming in direct contact with said

element, means for passing current through said heating element whereby the segregated water will be increasingly heated as it rises through the element and issue as steam from the exposed end of the same and means for floating said element on the body of water whereby the exposed portion of the element will remain substantially constant in position relative to the water level.

23. An apparatus for producing high pressure steam comprising a tank or receptacle for holding a body of water, a plurality of electrical heating elements in said tank, the ends of the elements being exposed to the medium above the water level in the receptacle; the said elements being adapted to isolate portions of the body of water, means for passing current through the elements for heating the same, whereby the isolated water will be increasingly heated as it moves up through the elements and issue as a mass of steam from the exposed ends thereof.

24. An apparatus for generating steam comprising a receptacle or tank for holding a body of water, a heating element having inlet and outlet ports located at the ends thereof and positioned in said tank or receptacle with an end of the element exposed to the medium above the water level; the exposed end of the element comprising the outlet port and means for passing current through the element for the heating of the same substantially throughout its length; the said element adapted to isolate a portion of the water and the parts being so constructed and arranged that the isolated water will be increasingly heated as it moves up in the element and issue as steam from the outlet port, the steam issuing in a direction from the said port perpendicular to the water level.

25. An improved method of generating steam which comprises floating a heated tube in water adapted to segregate a portion thereof for the heating of the same and the conversion of the same into steam, and a collection of the steam as it issues from the floating tubes.

26. An electrical steam generator, comprising a hollow tube, a float fixed to the hollow tube to support it in water with one end of said tube projecting above the surface of the water, and an electrical circuit attached to the tube to raise the temperature thereof to heat the water within the tube to cause steam to issue therefrom.

27. An electrical boiler and steam generator, comprising a tank to hold water, and appropriate number of hollow tubular conductors joined in series and electrically heated, and a float attached to the series of tubes to float the upper ends thereof above the surface of the water.

28. An improved method of generating steam and super-heating steam which comprises the use of an electrically heated tube in water, with part of the tube projecting above the surface of the water which discharges steam, and which projecting part of the heated tube is made of such appropriate length as to cause the steam to traverse considerable portion of the heated tube to superheat the steam before it discharges from the tube.

In witness whereof I hereunto affix my name this 8th day of October, 1920.

HYMAN E. COHEN.